CLAIMS

1. Method for estimating a nitrogen oxide mass stored in a nitrogen oxide catalytic trapping device (1), comprising a catalytic phase, and traversed by the exhaust gases (2) of an internal combustion engine (3) of a motor vehicle (4) comprising an electronic control unit (5), characterized in that:

- the geometry of the catalytic trapping device (1) is split into several (n) perfectly-stirred, successive individual reactors (6, 7); and
- a thermal model allowing calculation of the temperature variation of the catalytic phase of the catalytic trapping device (1) when traversed by the exhaust gases, is combined with an adsorption model allowing calculation at any time of the nitrogen oxide mass stored in the catalytic trapping device (1) as a function of the characteristics of the catalytic trapping device (1), the temperatures from the thermal model for each individual reactor, and the mass flow of exhaust gas from the engine (3).

2. Method according to claim 1, characterized in that a correction is carried out of the storage capacity of the nitrogen oxide catalytic trapping device (1) of each individual reactor i of order i (i = 1 to n) being a predetermined function of the temperature of the catalytic phase of the individual reactor i, said storage capacity being a function of corrective parameters comprising the hourly volume velocity of the individual reactor i, the ageing of the catalytic trapping device (1), and its sulphur poisoning.

3. Method according to claim 2, characterized in that the mass of nitrogen oxide instantaneously adsorbed (dNS_i/dt) by the catalytic trapping device (1) of each individual reactor i (i = 1 to n) is calculated using the following relationship:

$$\frac{dNS\_i}{dt} = NOx\_i * Eff\_i$$

in which:

NOx_i : mass flow of nitrogen oxides at the inlet of the individual reactor i, in g/s, NOx_1 calculated;

Eff_i : instantaneous storage efficiency in the individual reactor i, a predetermined function of NS_i/NSC_i and of T_i, obtained by looping the calculation of NS_i/NSC_i;

NS_i : nitrogen oxide mass present in the reactor i, in g;

NSC_i : maximum nitrogen oxide mass being able to be stored by the reactor i, in g;

T_i : temperature of the catalytic phase at the inlet of the individual reactor i, calculated by the thermal model, in K.

4. Method according to the claim 3, characterized in that the nitrogen oxide mass (NS_i) present in the individual reactor i is calculated using the following relationship:

$$NS\_i = \int_{t_0}^{t} \left(\frac{dNS\_i}{dt} \right) dt + NS\_i(t_0)$$

in which:

interval t_0 to t : interval of time between the end (t_0) of the last of regeneration phase of the catalytic trapping device (1) and the present time (t), in s; and

NS_i : nitrogen oxide mass present in the reactor i, in g.

NS_i (t_0) : estimated nitrogen oxide mass present in the reactor i at time t0 corresponding to the end of the last regeneration phase of the catalytic device (1), in g.

5. Method according to claim 4, characterized in that the total mass (NS) of nitrogen oxides stored in the entire catalytic trapping device (1) is calculated using the following relationship:

$$NS = \sum_{i=n}^{n} NS\_i$$

in which:

NS : total mass of nitrogen oxides stored in the entire catalytic trapping device (1), in g; and

NS_i : nitrogen oxide mass present in the individual reactor i, in g.

6. Method according to claim 5, characterized in that the flow of untreated nitrogen oxides leaving the last reactor n is calculated using the following relationship:

$$NOx\_exhaust\ outlet = NOx\_n * (1-Eff\_n)$$

in which:

NOx_exhaust outlet : mass flow of untreated nitrogen oxides, at the exhaust outlet after traversing the catalytic trapping device (1), in g/s;

NOx_n : mass flow of nitrogen oxides at the inlet of the last reactor n, in g/s; and

Eff_n : instantaneous storage efficiency in the last reactor n

7. Method according to claim 1, characterized in that the geometry of the catalytic trapping device (1) is split into a number of perfectly-stirred successive individual reactors comprised between 1 and 6.

8. Device for estimating a nitrogen oxide mass stored in a nitrogen oxide catalytic trapping device (1), comprising a catalytic phase, and traversed by the exhaust gases (2) of an internal combustion engine (3) of a motor vehicle (4), comprising an electronic control unit (5), characterized in that it comprises:

- means for splitting the geometry of the catalytic trapping device into several (n) perfectly-stirred, successive individual reactors; and
- means for estimating the nitrogen oxide mass present in the catalytic trapping device (1) by combining a thermal model allowing calculation of the temperature variation of the catalytic phase of the catalytic trapping device (1) when it is traversed by the exhaust gases, and an adsorption model allowing calculation at any time of the nitrogen oxide mass stored in the catalytic trapping device (1) as a function of the characteristics of the catalytic trapping device (1), the temperatures from the thermal model for each individual reactor, and the mass flow of exhaust gas from the engine (3).

9. Device according to claim 8, characterized in that it comprises means for carrying out a correction of the storage capacity of the nitrogen oxide catalytic trapping device (1) of each individual reactor i of order i, said correction being a predetermined function of the inlet temperature of the individual reactor i, and said storage capacity being a function of corrective parameters comprising the hourly volume velocity of the individual reactor i, the ageing of the catalytic trapping device (1), and its sulphur poisoning.

10. Method for the periodic regeneration of a nitrogen oxide catalytic trapping device (1) traversed by the exhaust gases (2) of an internal combustion engine (3) of a motor vehicle (4) comprising an electronic control unit (5), characterized in that the nitrogen oxide mass trapped in the catalytic trapping device (1) is estimated using the method according to claims 6 or 7, or with a device according to claims 8 or 9.